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10/522,027	01/21/2005	Shuji Sugeno	1295.4468X00	1571
20457 7590 04/09/2008 ANTONELLI, TERRY, STOUT & KRAUS, LLP 1300 NORTH SEVENTEENTH STREET SUITE 1800 ARLINGTON, VA 22209-3873				
EXAMINER THOMAS, MIA M				
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Please find below and/or attached an Office communication concerning this application or proceeding.

The time period for reply, if any, is set in the attached communication.

Office Action Summary

Application No.

10/522,027

Applicant(s)

SUGENO ET AL.

Examiner

Mia M. Thomas

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Period for Reply -- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 29 February 2008.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1-4, 6-8, 10 and 11 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1-4, 6-8, 10 and 11 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 29 February 2008 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
- Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
- Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
 2. ☐ Certified copies of the priority documents have been received in Application No. _____.
 3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☐ Information Disclosure Statement(s) (PTO/SB08)
- Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
- Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application
- 6) ☐ Other: _____

DETAILED ACTION

Response to Amendment

1. This Office Action is made responsive to applicant's remarks received on 29 February 2008. Claim 1 has been amended, and claims 5 and 9 cancelled. Accordingly claims 1-4, 6-8, 10 and 11 remain pending in the application. Claim 1 is independent.

Priority

2. Receipt is acknowledged of papers submitted under 35 U.S.C. 119(a)-(d), which papers have been placed of record in the file.

Claim Rejections - 35 USC § 112

3. The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

4. Claim 1 is rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention. It is unclear to the Examiner if the original image (as stated at line 12 of claim 1) is the same as the "input image" (as stated at line 11 of claim 1). Which image is the image that the arithmetic unit will process accordingly with the low-frequency components? According to page 6, lines 4-6, "the arithmetic unit 18 subtracts the output image (unsharpened image) of the LUT 14 from the input image and outputs an image in which the low-frequency components of the input image are compressed. It appears that from the specification at page 6, the original image is the image from the LUT (look-up table) 14 which is being subtracted from the output image. Appropriate correction is required.

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The following will be assumed for examination purposes:

Claim 1: (Currently Amended) An image processing device, comprising:

recursive filtering means...

low-frequency component compression means...

arithmetic means for compressing the low-frequency components of the input image by

subtracting the output image (unsharpened image) of the original image from the input image in

which the output image is an image in which the low frequency components of the input image are compressed.

Claim Rejections - 35 USC § 103

5. The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

6. Claims 1-4, 6-8, 10 and 11 are rejected under 35 U.S.C. 103(a) as being unpatentable over Makram-Ebeid (US 6,466,700 B1) in combination with Florent (US 6,151,417) and Tsuchiya et al (US 6,724,943 B2).

Regarding Claim 1: (Currently Amended)-***As best understood by the Examiner***, Makram-Ebeid discloses an image processing device ("The invention relates to an image processing method for preserving the edges of objects reproduced in an intensity image and for reducing the noise..." at abstract), comprising: recursive filtering means for smoothing an input image ("...and passage at each point of a recursive spatial filter having an anisotropic kernel and providing a degree of smoothing which is

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greater in the direction perpendicular to the direction to the gradient than in the direction of the intensity gradient... An advantage of the method according to the invention resides in the fact that it is recursive, so that it can be carried out very economically in respect of calculations because each application of the filter to a point utilizes calculation elements which have already been performed." at column 1 lines 66-column 2, line 19), the recursive filtering means including edge setting means for setting at least one edge having a predetermined angle from a scanning line direction of the input image (Refer to Figure 2, wherein Makram-Ebeid discloses that the method of recursive filtering as applied to a predetermined angle as shown at Figures 4a-4b)

and control means for smoothing the image to be smoothed in correspondence with the edge set by the edge setting means (Refer to Figure 3, numeral 700);

Florent teaches low-frequency component compression means (Refer to Figure 3a, numeral 24) for setting an amount of compression of low-frequency components of the input image according to an output of the recursive filtering means; (Refer to Figure 3a, numeral 27-"Lookup Table"; "...two-dimensional spatial filtering means ($F(2D)$) which are applied to said difference image in order to enhance spatially coherent samples and to supply a measure of probability of motion ($\beta(t)$) which is linked to said spatially coherent samples,...means for applying a scalar function ($f(1)$) to said measure of probability of motion ($\beta(t)$) to supply an output coefficient ($\alpha(t)$) and...means for generating said recursion factor ($K(t)$) in dependence on said output coefficient ($\alpha(t)$). " at column 7, line 16).

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arithmetic means for compressing the low-frequency components of the input image by subtracting the output image (unsharpened image) of the original image from the input image in which the output image is an image in which the low frequency components of the input image are compressed ("The system includes recursive temporal filtering means which include means for forming a sum of a corresponding sample ($Y(t-1)$) of an already filtered preceding image of the sequence and a corresponding sample $[(\Delta)(t)(x,y)]$ of a difference image ($S(t) - Y(t-1)$) formed between the noisy image and the filtered preceding image and weighted by a recursion factor ($K(t)$)...at abstract); (Refer to Figure 1B; The system of figure 1 performs the processing of the images as shown at Figure 2a and 2b). Additionally, refer to column 2, line 60-column 3, line 2.

Tsuchiya teaches by way of example, control means for smoothing the image to be smoothed in correspondence with the edge set by the edge setting means ("In addition to this, by heightening the smoothing effect in, for instance, the dark region and/or the bright region of image, the look-up table 11 enables to control also the smoothing effect in accordance with the pixel value, such as increasing the degree of enhancement by the image enhancement processing on the succeeding stages." at column 3, line 27).

For clarity, Examiner shows at column 1, lines 7-19 that the invention is the image processing method for edge preservation. "The invention also related to a medical imaging apparatus which includes a system for carrying out this method." The processing device of this instant application is equivalent to applicant's processing device as rejected accordingly by way of implementation

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of the method onto which this device shall be executed.

All these claimed elements as stated and rejected above were known in the prior art and one skilled in the art could have combined the recursive filtering means as disclosed by Makram-Ebeid with the low-frequency component compression means as taught by Florent and the control means as taught by Tsuchiya to obtain the claimed invention as set forth at claim 1.

Makram-Ebeid, Florent and Tsuchiya are all in the same field of adaptive and recursive filtering.

At the time that the invention was made, it would have been obvious to one of ordinary skill in the art to combine these claimed elements by known methods with no change in their respective functions, and the combination of these claimed elements would have yielded predictable results to one of ordinary skill in the art at the time of the invention.

Further, the combination of these claimed elements would allow the user to more efficiently process images while preserving the edges of objects reproduced by the image processing device of this invention. The filtering allows the device to reduce the noise in the images and also produces a kernel for scanning in any particular direction which allows the user to extend the field of view of the image at a given point.

Regarding Claim 2: (Original) Tsuchiya teaches display means of displaying the input image ("The camera signal processing circuit 45 applies the stated data processing to the output image data S18, and then sends and records the resulted output image data S19 onto a Video Tape Recorder (VTR) 46." at column 6, line 17; "In addition, in the above-mentioned

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embodiments, such aspects have been described that the present invention has been applied to video cameras 1, 50 and 60; however, the present invention is applicable not merely to such, but to the other wide variety of image processing devices, such as an electronics still camera, a printer, a display unit, and a computer." at column 11, line 45); and region of interest setting means of setting a region of interest in the input image displayed in the display means, wherein the edge setting means sets the edge on the basis of the region of interest set by the region of interest setting means (Refer to column 11, lines 59-65).

Regarding Claim 3: (Original) Tsuchiya teaches low-frequency component compression means (Refer to Figure 2, numeral 10) of setting an amount of compression by which low-frequency components of the input image are compressed according to the smoothed image generated by the recursive filtering means (Further refer to Figure 2, numerals 12a-12n, 13 and 35), wherein the control means changes an output from the recursive filtering means on the basis of the compression amount set by the low-frequency component compression means ("In addition to this, by heightening the smoothing effect in, for instance, the dark region and/or the bright region of image, the look-up table 11 enables to control also the smoothing effect in accordance with the pixel value, such as increasing the degree of enhancement by the image enhancement processing on the succeeding stages." at column 3, line 27).

Regarding Claim 4: (Original) Florent teaches wherein the low-frequency component compression means (Refer to Figure 3a, numeral 24) has lookup table means (Refer to Figure 3a, numeral 27-"Lookup Table") supplied with an output value from the recursive filtering means and converting the output value into a value obtained by multiplying the output value by a

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predetermined coefficient("In addition to this, by heightening the smoothing effect in, for instance, the dark region and/or the bright region of image, the look-up table 11 enables to control also the smoothing effect in accordance with the pixel value, such as increasing the degree of enhancement by the image enhancement processing on the succeeding stages." at column 3, line 27; "...two-dimensional spatial filtering means (F(2D)) which are applied to said difference image in order to enhance spatially coherent samples and to supply a measure of probability of motion (beta(t)) which is linked to said spatially coherent samples....means for applying a scalar function (f(1)) to said measure of probability of motion (beta(t)) to supply an output coefficient (alpha(t)) and...means for generating said recursion factor (K(t)) in dependence on said output coefficient (alpha(t))." at column 7, line 16).

Regarding Claim 5: (Cancelled).

Regarding Claim 6: (Original) Tsuchiya discloses wherein the recursive filtering means

performs processing expressed by $g(t) = k \cdot f(t) + (1 - k) \cdot g(t - 1)$

where $g(t)$ is the output from the recursive filtering means (The nonlinear smoother 5 extracts the edge components, the pixel values of which change abruptly, out of this input image data S1, and outputs the edge components as it is without smoothing it, while smoothes the small-amplitude components other than the edge components, and hereby smoothes the input image data S1, conserving the edge components of the input image data S1." at column 2, line 58).

k is a filter coefficient (Refer to Figure 2, numeral 12a-"epsilon filter"),

$f(t)$ is the input image ("input image data S1"),

$1 - k$ is a feedback rate (Refer to Figure 3, additionally, refer to Figure 14, for illustrations of multiple feedback responses at different rates throughout.)

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and $g(t - 1)$ is the output from the recursive filtering means one-line before, and changes the feedback rate ($l-k$) on the basis of the magnitude of the difference (d) between the input image ($f(t)$) and the output value ($g(t - 1)$) of the recursive filtering means one-line before ("The epsilon-filter 12A, which is a nonlinear smoothing filter,... it smoothes the image data $S3$,... and then sends the resulted smoothed image data $S4A$ to an epsilon-filter 12B. In the case where the pixel for filter processing is one-dimensional and $2N+1$ tap, the smoothing processing at this epsilon-filter 12A is represented with the following equation (Refer to equation 1). That is, the epsilon-filter 12A compares the absolute value absolute value of $x(n) - x(n-k)$, of the difference between the pixel value $x(n)$ of a central pixel $p(n)$ and the pixel value $x(n-k)$ of a pixel $p(n-k)$ of filter processing with the stated threshold value epsilon." at column 3, line 34) For further clarity, the multiple mathematical manipulations of these equations are found at column 3, lines 58-column 5, line 67).

Regarding Claim 7: (Original) Makram-Ebeid discloses wherein the recursive filtering means separately generate smoothed images with respect to edges in direction at 45° from the scanning line direction of the input image (left- downward direction) (Refer to Figure 3b, specifically where $S = (\text{square root of } 2)$), a direction at 90° from the scanning line direction (downward direction) (Refer to Figure 3b, specifically where $S = 1$) and a direction at 135° from the scanning line direction (right-downward direction) (Refer to Figure 3b, specifically where $S = (\text{square root of } 3)$).

Regarding Claim 8: (Original) Florent teaches wherein weighting averaging is performed on the smoothed images separately generated with respect to the edges by the recursive filtering

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means ("The dimension of the supports of the sub-filters is $W2$ along the axes $QZ1, \dots, QZN$ and $W1$ in the direction perpendicular to said axes, where $W2 > W1$. For example, $W1$ equals 1 or 2 pixels and $W2$ equals from 5 to 10 pixels. The sub-filters form mean values with coefficients which are constant or decrease from the extreme point $Q(t) (x,y)$. For example, $N=8$ directions suffice. At the point $Q(t) (x,y)$ the sub-filters calculate a number N (for example, 8) of mean values which are referenced $M(1) (Q), M(2) (Q), \dots, M(8)(Q)$," at column 5, line 3).

Regarding Claim 9: (Cancelled).

Regarding Claim 10: (Original) Tsuchiya discloses delay means of delaying the input image with respect to time processing (Refer to Figure 1, numeral 4-"Delay Circuit") performed by the processing means including the recursive filtering means (Refer to Figure 1, numeral 3-"Image Processing Circuit"), wherein the input image delayed by the delay means is input as the original of the image input to the arithmetic means (Refer to Figure 1, numerals S15-S17; additionally, the input image to be delayed is S1).

Regarding Claim 11: (Original) Florent discloses wherein the recursive filtering means (Refer to Figure 7, numeral 50) comprises:

a first line memory in which one line of the input image is stored (Refer to Figure 1b, numeral 15);

a second line memory in which line data before storage in the first line memory is stored (Refer to Figure 3b, numeral 26, specifically with the directional's of $K(t)$ and $K(t-1)$);

an arithmetic device which subtracts the line data stored in the first line memory from the line

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data stored in the second line memory ("In a version 120 the recursion factor $K(t)$ is calculated in a simple manner, in the block 25, by way of a first function which is written as (note equation 6(a)), further reference lines 6-15, column 6);

lookup table means of converting the difference value obtained by subtraction performed by the arithmetic device into a value obtained by multiplying the difference value by a filter coefficient (Refer to Figure 3a, numeral 27-"Look-Up Table"); and

an adder which adds together the value converted by the lookup table means as a result of multiplication by the filter coefficient and the line data stored in the second line memory (Refer to Figures 3a and 3b, numeral 22).

Response to Arguments

7. Applicant's arguments filed 29 February 2008 have been fully considered and a complete response to those remarks is provided below.

Summary of Remarks:

A. Specification—Applicant has revised the specification to provide a new title, as suggested in the Office Action. "Edge Preservation Type Image Processing Device"

Examiner's Response:

B. Examiner withdraws the object to the specification. New title is entered herewith this Office Action.

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Summary of Remarks:

- C. Rejection under 35 USC 102—As amended, independent Claim 1 defines an image processing device that is detailed at page 8.
- D. Rejection under 35 USC 103—The combination of Tsuchiya and Florent still fails to disclose or suggest all of the features recited in the claimed invention (as amended) at page 11.

Examiner's Response:

- E. Applicant's arguments with respect to claims 1-11 have been fully considered but are moot in view of the new ground(s) of rejection.

The Examiner has relied upon the combination of Makram-Ebeid, Florent and Tsuchiya to reject the aforementioned claims as rejected above.

Conclusion

8. Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire THREE MONTHS from the mailing date of this action. In the event a first reply is filed within TWO MONTHS of the mailing date of this final action and the advisory action is not mailed until after the end of the THREE-MONTH shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

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Any inquiry concerning this communication or earlier communications from the examiner should be directed to Mia M. Thomas whose telephone number is (571)270-1583. The examiner can normally be reached on Monday-Thursday 8am-5pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Vikram Bali can be reached on 571-272-7415. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

/Mia M Thomas/
Examiner, Art Unit 2624

/Vikram Bali/
Supervisory Patent Examiner, Art Unit 2624